PATENT COOPERATION TREATY

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:

G.E. EHRLICH (1995) LTD.
11 Menachem Begin Street
52 521 Ramat Gan
ISRAEL

PCT

NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY
(PCT Rule 71.1)

Date of mailing *(day/month/year)*	14.03.2007
Applicant's or agent's file reference 29222	**IMPORTANT NOTIFICATION**

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/IL2005/000509	17.05.2005	17.05.2004

Applicant
EPOS TECHNOLOGIES LIMITED et al.

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary report on patentability and its annexes, if any, established on the international application.

2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.

3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

4. **REMINDER**

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary report on patentability. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

The applicant's attention is drawn to Article 33(5), which provides that the criteria of novelty, inventive step and industrial applicability described in Article 33(2) to (4) merely serve the purposes of international preliminary examination and that "any Contracting State may apply additional or different criteria for the purposes of deciding whether, in that State, the claimed inventions is patentable or not" (see also Article 27(5)). Such additional criteria may relate, for example, to exemptions from patentability, requirements for enabling disclosure, clarity and support for the claims.

Name and mailing address of the international preliminary examining authority:	Authorized Officer
European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Thomas, Roger Tel. +49 89 2399-2247

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 29222	**FOR FURTHER ACTION**	See Form PCT/IPEA/416
International application No. PCT/IL2005/000509	International filing date *(day/month/year)* 17.05.2005	Priority date *(day/month/year)* 17.05.2004

International Patent Classification (IPC) or national classification and IPC
INV. G06F3/033

Applicant
EPOS TECHNOLOGIES LIMITED et al.

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 7 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
   a. ☒ *sent to the applicant and to the International Bureau)* a total of 11 sheets, as follows:
      ☒ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
      ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
   b. ☐ *(sent to the International Bureau only)* a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in electronic form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

☒	Box No. I	Basis of the report
☐	Box No. II	Priority
☐	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
☐	Box No. IV	Lack of unity of invention
☒	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
☐	Box No. VI	Certain documents cited
☐	Box No. VII	Certain defects in the international application
☒	Box No. VIII	Certain observations on the international application

Date of submission of the demand	Date of completion of this report
02.11.2006	14.03.2007

Name and mailing address of the international preliminary examining authority:

European Patent Office
D-80298 Munich
Tel. +49 89 2399 - 0 Tx: 523656 epmu d
Fax: +49 89 2399 - 4465

Authorized officer

Valin, Steven

Telephone No. +49 89 2399-5975

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/IL2005/000509

Box No. I Basis of the report

1. With regard to the **language**, this report is based on

   ☒ the international application in the language in which it was filed

   ☐ a translation of the international application into , which is the language of a translation furnished for the purposes of:
   - ☐ international search (under Rules 12.3(a) and 23.1(b))
   - ☐ publication of the international application (under Rule 12.4(a))
   - ☐ international preliminary examination (under Rules 55.2(a) and/or 55.3(a))

2. With regard to the **elements*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

Description, Pages	
1-38	as originally filed
Claims, Numbers	
1-63	filed with telefax on 01.03.2007
Drawings, Sheets	
1/8-8/8	as originally filed

   ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing

3. ☐ The amendments have resulted in the cancellation of:
   - ☐ the description, pages
   - ☐ the claims, Nos.
   - ☐ the drawings, sheets/figs
   - ☐ the sequence listing *(specify)*:
   - ☐ any table(s) related to sequence listing *(specify)*:

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
   - ☐ the description, pages
   - ☐ the claims, Nos.
   - ☐ the drawings, sheets/figs
   - ☐ the sequence listing *(specify)*:
   - ☐ any table(s) related to sequence listing *(specify)*:

* *If item 4 applies, some or all of these sheets may be marked "superseded."*

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-63
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-63
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-63
	No:	Claims	

2. Citations and explanations (Rule 70.7):

see separate sheet

Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1 PRIOR ART

Reference is made to the following documents:

D1: WO 03/088136 A (EPOS TECHNOLOGIES LIMITED; ALTMAN, NATHAN; ELIASHIV, ODED) 23 October 2003 (2003-10-23) cited in the application
D2: US-A-4 814 552 (STEFIK ET AL) 21 March 1989 (1989-03-21)
D3: EP-A-0 312 481 (EZQUERRA PEREZ, JOSE MANUEL; SANCHEZ FERNANDEZ, FRANCISCO JOSE; NOMBEL) 19 April 1989 (1989-04-19)

D3 teaches of an ultrasonic position detection system in which the position of an object is established by geometric triangulation using distance measurement data obtained from an ultrasonic transmitter attached to the object being monitored and from physically separated ultrasonic receivers. Operating synchronisation is provided by an infrared emitter located on the object and which delivers a signal at the instant the ultrasonic emitter delivers a signal, thus, allowing the ultrasonic transmission time to be utilised as a measure of distance. In another embodiment, the infrared emitter is associated with the receiver system which delivers a signal to a reciever at the object petitioning the ultrasonic emitter to transmit a signal, thus providing greater precision.

D2 also discloses an ultrasound position input device for a computer system. In operation, the stylus transmits an infrared signal which the system receives immediately and an ultrasound pulse which two microphones receive after a delay which is a function of the speed of sound and the distance of the stylus from each microphone. From this information the system can calculate the position of the stylus. Switches for indicating functions are mounted on the stylus. Multiple styluses can be used, each transmitting a distinctive identification code so that the system can determine which stylus is the signal source.

D1, from the same applicant as the present application, teaches of an acoustic-based

position detection system comprising a positional element for attaining a position and comprising a first emitter for emitting a substantially continuous ultrasonic waveform decodable to fix said position, and a detector arrangement for detecting said waveform in a manner permitting fixing of said position and outputting said waveform for computation, in a manner retentive of said position fixing ability. The positional element also comprises a second emitter, operable to use IR or RF signaling, and used for timing the ultrasonic waveform. To address the synchronization issue between the positional element and the base station (positioning device), it is suggested that the positional element comprise a detector and the base station an emitter for sending a command to the positional element via, for example, an infrared signal in order to signal the pointing device to emit the ultrasonic waveform.

2 INDEPENDENT CLAIM 1

Document D1, which is considered to represent the most relevant state of the art, discloses an acoustic-based positioning system from which the subject-matter of claim 1 differs in that claim 1 includes a synchronization signal which is transmitted by the positional element to the positioning device within a time frame having a fixed duration and is continuously repeated, said time frame being known to the positioning device, and said synchronization signal being a sequence of at least two synchronization sub-signals, each synchronization sub-signal bearing timing data for the continuously modulated acoustic waveform, thereby to improve the accuracy of the fixing of the position, said at least two synchronization sub-signals allowing the positioning device to derive clock clock synchronization data by correlating said timing data and said known time frame duration.

The subject-matter of claim 1 is therefore new (Article 33(2) PCT).

The problem to be solved by the present invention may be regarded as how to improve the accuracy of the position fixing of the device disclosed in D1.

The solution to this problem proposed in claim 1 of the present application is considered as involving an inventive step (Article 33(3) PCT) because none of the prior art uncovered in the international search appears to disclose or suggest the use of a synchronization signal as described in claim 1 to improve the accuracy of an acoustic based positioning

system according to claim 1.

To address the synchronization issue between the positional element and the base station (i.e., positioning device), it is suggested in D1 the base station further comprise an emitter for sending a command to the positional element via, for example, an infrared signal, in order to signal the pointing device to emit the ultrasonic waveform; and that the positional element of D1 further comprise a detector for detecting said signal. Thus, D1 appears to teach away from the solution proposed in claim 1.

While D1 does suggest that in order to solve the synchronization problem found in D1 between the base station (positioning device) and the host (PC), the base station could send a synchronization pattern in a certain time or frequency slot and that the host could use this pattern to determine the phase difference between its own clock and the base clock, it does not suggest that the positional element send this pattern to the base station nor that the synchronization pattern be a signal comprised of at least two sub-signals, each bearing timing data for the acoustic waveform.

Thus, the solution to this problem proposed in claim 1 of the present application is considered as involving an inventive step (Article 33(3) PCT).

Claims 2-32 are dependent on claim 1 and as such also meet the requirements of the PCT with respect to novelty and inventive step.

3 INDEPENDENT CLAIM 33

Independent method claim 33 is the method-claim analog to independent system claim 1 and, therefore, the same reasoning applies, *mutatis mutandis*, to the subject-matter of claim 33, which is, therefore, also deemed to be novel and involving an inventive step (Articles 33(2) and 33(3) PCT).

Claims 34-62 are dependent on claim 1 and as such also meet the requirements of the PCT with respect to novelty and inventive step.

4 INDEPENDENT CLAIM 63

Independent claim 63 is directed to a system with the same features as the system of claim 1, with the addition of another detector arrangement for additionally determing the attitude of a positional element. This claim, having all of the features of claim 1, should, in accordance with Article 6 PCT and the requirements of concisness and clarity, should be drafted as a dependent claim. However, this lack of clarity notwithstanding, the subject-matter of the claim is considered to be novel and to involve an inventive step in the sense of Articles 33(2) and 33(3) PCT for the same reasons as the subject-matter of claim 1, applied, *mutatis mutandis*, to claim 63.

Re Item VIII

Certain observations on the international application

The above report was carried out based on the following assumptions in order to overcome remaining minor clarity issues.

1 Claim 1

Beginning at the third line from the bottom of this claim, the phrase "said at least one positional device" has been understood as "said positioning device." Support for this interpretation is found on p. 8, ll. 5-6 of the Description.

2 Claim 63

Beginning at the third line from the bottom of this claim, the phrase "said positional device" has been understood as "said positioning device." Support for this interpretation is also found on p. 8, ll. 5-6 of the Description.

WHAT IS CLAIMED IS:

Claims:

1. A position detection system for use in association with computing applications, said position detection system comprising:

at least one positional element for attaining a position, said positional element comprising:

at least one first emitter for emitting a substantially continuously modulated acoustic waveform decodable to fix said position, and

a second emitter for emitting a synchronization signal;

a positioning device operative to determine a position of said positional element, said positioning device comprising:

an arrangement of at least one of a first detector operative to detect said continuously modulated acoustic waveform in a manner permitting fixing of said position and outputting said waveform for computation, in a manner retentive of said position fixing ability; and

a second detector operative to detect said synchronization signal;

said synchronization signal being transmitted within a time frame having a fixed duration and being continuously repeated, said time frame being known to said positioning device, said synchronization signal being a sequence of at least two synchronization sub-signals, each synchronization sub-signal bearing timing data for said continuously modulated acoustic waveform, thereby to improve accuracy of said fixing of said position, said at least two synchronization sub-signals allow said at least one positional device to derive clock synchronization data by correlating said timing data and said known time frame duration.

2. A position detection system according to claim 1 wherein said acoustic waveform is an ultrasonic waveform.

3. A position detection system according to claim 1 wherein said synchronization signal is an electromagnetic signal.

4. A position detection system according to claim 1 wherein said synchronization signal is an infrared signal.

5. A position detection system according to claim 1 wherein said synchronization signal is a radio signal.

6. A position detection system according to claim 1 wherein said timing data comprises a measure of time elapsed between an identifiable component of said acoustic waveform and time of transmission of said synchronization signal.

7. A position detection system according to claim 6 wherein:

said positional element additionally comprises a first clock;

said positioning device additionally comprises a second clock; and

said synchronization signal comprises clock synchronization data useful to synchronize between said first clock and said second clock.

8. A position detection system according to claim 1 wherein said synchronization signal additionally comprises identification data of said positional element.

9. A position detection system according to claim 1 wherein said synchronization signal is transmitted within at least one time slot, said one time slot being randomly selected from a fixed number of time slots provided within said time-frame.

10. A position detection system according to claim 9 wherein said synchronization signal additionally comprises identification data of said time-frame and identification data of said time slot within said time-frame bearing said synchronization signal.

11. A position detection system according to claim 10 wherein said time-frame identification data is a counter of said time-frames and said time slot identification data is a location numeral of said time slot within said time-frame bearing said synchronization signal.

12. A position detection system according to claim 10 wherein said time-frame has a duration, said duration being known to said positioning device and wherein data of said clock synchronization is derived by said positioning device by correlating a received time-frame duration and said known time-frame duration.

13. A position detection system according to claim 12 wherein said clock synchronization data is derived by linearly interpolating a sequence of respective received time-frame durations and said known time-frame duration.

14. A position detection system according to claim 12 wherein said clock synchronization data is derived by using a phase lock loop between a sequence of respective received time-frame durations and said known time-frame duration.

15. A position detection system according to claim 1 wherein said acoustic waveform is selected from a predefined set of acoustic waveforms wherein said synchronization signal additionally comprises an identification data of said selected acoustic waveform.

16. A position detection system according to claim 1 wherein said modulation is an amplitude modulation.

17. A position detection system according to claim 1 wherein said modulation is a frequency modulation.

18. A position detection system according to claim 1 wherein said modulation is a phase modulation.

19. A position detection system according to claim 1 wherein said synchronization signal comprises an error correction code.

20. A position detection system according to claim 19 wherein said error correction code comprises at least one cyclic redundancy character.

21. A position detection system according to claim 1 wherein said synchronization signal additionally comprises identification data of a change of a status of at least one discrete input.

22. A position detection system according to claim 21 wherein said discrete input is a state of a switch.

23. A position detection system according to claim 21 wherein said synchronization signal additionally comprises a measure of time elapsed between said change of status of said discrete input and transmission of said synchronization signal.

24. A position detection system according to claim 23 wherein said measure of elapsed time comprises a count of said synchronization signals transmitted between said change of status of said discrete input and said transmission of said synchronization signal.

25. A position detection system according to claim 24 wherein said count of said synchronization signals is limited and when said limit is reached said count remains at said limit until a next occurrence of a change of status of a switch.

26. A position detection system according to claim 1 wherein said synchronization signal additionally comprises at least one measurement data of at least one of an analog input and a digital input.

27. A position detection system according to claim 1 wherein said first detector arrangement comprises a single detector.

28. A position detection system according to claim 1 wherein said first detector arrangement comprises at least two detectors and is operative to determine said position in two dimensions.

29. A position detection system according to claim 1 wherein said first detector arrangement comprises at least three detectors and is operative to determine said position in three dimensions.

30. A position detection system according to claim 1 wherein said positional element is associated with at least one of a computer pointing device and a writing device.

31. A position detection system according to claim 1 wherein said positional element is associated with at least one of a mobile device and a portable device.

32. A position detection system according to any of the preceding claims and wherein said positional element is a plurality of positional elements.

33. A position detection method for measuring a position of a positional element by a positioning device, said method comprising the steps of:

providing a first clock at the positional element;

emitting a substantially continuously modulated acoustic waveform at said position of said positional element, said waveform synchronized with said first clock and decodable to fix said position,

emitting a synchronization signal at said position of said positional element, said synchronization signal being a sequence of at least two synchronization sub-signals, each synchronization sub-signal bearing timing data for said continuously modulated acoustic waveform, said synchronization signal being transmitted within a time frame having a fixed duration and being continuously repeated, said time frame being known to said positioning device, said timing data synchronized with said first clock;

providing a second clock at said positioning device;

receiving said acoustic waveform by said positioning device, via an arrangement of at least one of a first detector operative to detect said continuously modulated acoustic waveform in a manner permitting fixing of said position and outputting said waveform for computation, in a manner retentive of said position fixing ability;

receiving said synchronization signal by said positioning device,

deriving clock synchronization data from said synchronization signal by correlating said timing data and said time frame being known to said positioning device;

synchronizing said second clock with said first clock by said positioning device according to said clock synchronization data; and

computing said position of said positional device using said timing data and acoustic waveform.

34. A position detection method according to claim 33 wherein said acoustic waveform is an ultrasonic waveform.

35. A position detection method according to claim 33 wherein said synchronization signal is an electromagnetic signal.

36. A position detection method according to claim 33 wherein said synchronization signal is an infrared signal.

37. A position detection method according to claim 33 wherein said synchronization signal is a radio signal.

38. A position detection method according to claim 33 wherein said timing data comprises a measure of time elapsed between an identifiable component of said acoustic waveform and time of transmission of said synchronization signal.

39. A position detection method according to claim 33 wherein said synchronization signal additionally comprises identification data of said positional element.

40. A position detection method according to claim 33 wherein said emitting of said synchronization signal comprises:

providing a time-frame;

providing a fixed number of time slots within each said time-frame;

randomly selecting one of said time slots within each said time-frame; and

emitting said synchronization signal within said selected time slot.

41. A position detection method according to claim 40 wherein said synchronization signal additionally comprises identification data of said time-frame and identification data of said time slot within said time-frame bearing said synchronization signal.

42. A position detection method according to claim 41 wherein said time-frame identification data is a counter of said time-frames and said time slot identification data is a location numeral of said time slot within said time-frame bearing said synchronization signal.

43. A position detection method according to claim 41 and additionally comprising:

providing said time-frame duration to said positioning device in advance;

deriving data of said clock synchronization by said positioning device by correlating said received time-frame duration and a known time-frame duration.

44. A position detection method according to claim 43 wherein said step of deriving said clock synchronization data is performed by linearly interpolating a sequence of received time-frame durations and said known time-frame duration.

45. A position detection method according to claim 43 wherein said step of deriving clock synchronization data is performed by using a phase lock loop between a sequence of received time-frame durations and said known time-frame duration.

46. A position detection method according to claim 33 wherein said step of emitting said acoustic waveform additionally comprises randomly selecting said acoustic waveform from a predefined set of acoustic waveforms; and wherein said step of emitting a synchronization signal additionally comprises emitting identification data of said selected acoustic waveform.

47. A position detection method according to claim 46 wherein said acoustic waveform is a continuously modulated acoustic waveform.

48. A position detection method according to claim 47 wherein said modulation is a frequency modulation.

49. A position detection method according to claim 47 wherein said modulation is a phase modulation.

50. A position detection method according to claim 33 wherein said synchronization signal comprises an error correction code.

51. A position detection method according to claim 50 wherein said error correction code comprises at least one cyclic redundancy character.

52. A position detection method according to claim 33 wherein said step of emitting said synchronization signal additionally comprises emitting identification data of a change of a status of at least one discrete input.

53. A position detection method according to claim 52 wherein said discrete input is a state of a switch.

54. A position detection method according to claim 52 wherein said step of emitting said synchronization signal additionally comprises emitting a measure of time elapsed between said change of status of said discrete input and a transmission of said synchronization signal.

55. A position detection method according to claim 54 wherein said measure of elapsed time comprises a count of a number of said synchronization signals transmitted between said change of status of said discrete input and said transmission of said synchronization signal.

56. A position detection method according to claim 55 wherein said count of said synchronization signals is limited and when said limit is reached said count remains at said limit until a next occurrence of a change of status of a switch.

57. A position detection method according to claim 33 wherein said step of emitting said synchronization signal additionally comprises emitting at least one measurement data of at least one of an analog input and a digital input.

58. A position detection method according to claim 33 wherein said step of receiving said acoustic waveform at said first detector arrangement comprises receiving said acoustic waveform at least three first detectors.

59. A position detection method according to claim 33 wherein said step of receiving said acoustic waveform at said first detector arrangement comprises receiving said acoustic waveform via at least two first detectors and wherein said step of computing said position of said positional device comprises fixing said position in two dimensions.

60. A position detection method according to claim 33 wherein said step of receiving said acoustic waveform at said first detector arrangement comprises receiving said acoustic waveform via at least three first detectors and wherein said step of computing said position of said positional device comprises fixing said position in three dimensions.

61. A position detection method according to any of claims 33 - 60 and wherein said positional element comprises a plurality of positional sub-elements.

62. A position detection method according to claim 33, wherein said step of emitting a sequence of synchronization signals starts at a predefined delay after emitting said identifiable component of said acoustic waveform, wherein said predefined delay is known to said positioning device, and wherein said step of synchronizing said second clock with said first clock uses said predefined delay to synchronize said second clock and said first clock.

63. A position detection system for use in association with computing applications, the system comprising: a positional element for attaining a position and comprising a first emitter and a second emitter each for emitting a continuously modulated acoustic waveform decodable to fix said position, the emitters being a predetermined distance apart, said two emitters sending orthogonal codes; and

a detector arrangement for detecting said waveforms in a manner permitting fixing of said position and permitting determination of an attitude of said positional element, the detector arrangement further being operable to output said waveforms for computation, in a manner retentive of said position fixing ability;

said positional element further comprising a third emitter for emitting a synchronization signal;

said detector arrangement further comprising an additional detector operative to detect said synchronization signal, said synchronization signal, being transmitted within a time frame having a fixed duration and being continuously repeated, said time frame being known to said positioning device, said synchronization signal;

said synchronization signal being a sequence of at least two synchronization sub-signals, each synchronization sub-signal bearing timing data for said continuously modulated acoustic waveform and respective pressure data; and

said detector arrangement being operative to estimate a virtual straight line connecting said first emitter, said second emitter and a virtual point on a screen associated with said computing application

wherein said at least two synchronization sub-signals allow said positional device to derive clock synchronization data by correlating said timing data and said known time frame duration.